

Growing

ORIENTAL CABBAGES

in hawaii

50
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About the Author

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GROWING ORIENTAL CABBAGES IN HAWAII

Foreword

Several types of oriental cabbage are commonly grown for the market in Hawaii. Among these are two varieties of Chinese head cabbage (Won bok and Chiefoo), green mustard cabbage (Kai choy), and white mustard cabbage (Pak choy), the three most commonly grown. Other types of oriental cabbage include spoon cabbage (Shakushina) and Mizuna (Potherb mustard cabbage).

Approximately 2,710,000 pounds of Chinese head cabbage and 920,000 pounds of the green and white mustard cabbage varieties were produced in 1954 for the Hawaiian market.

The Chinese head cabbage is used mostly for salads, and also for cooking and pickling. Mustard cabbages are used in cooking and pickling.

Varieties

Of the two varieties of Chinese head cabbage which are commonly grown in the islands, the Won bok variety has the lightest shade of green in the leaves and forms a head with a blunt tip. This variety produces heads averaging 3-5 pounds in weight and matures in 60-70 days.

The Chiefoo variety has darker green leaves and forms a head with a pointed tip. It matures in 75-90 days and forms a head averaging 5-10 pounds in weight. The Chiefoo is adapted to cool growing conditions and is, therefore, grown chiefly at the higher elevations. Its large size is usually unacceptable for the fresh market trade and the bulk of it is produced for pickling.

The Won bok, on the other hand, with its smaller heads, is adapted to the warmer growing conditions of the lowlands. Accordingly, it is grown chiefly in the lowland areas of Oahu, both for the fresh market and the pickling trade.

There are several strains of both the Won bok and Chiefoo varieties of Chinese head cabbages. Several field trials conducted at both low and high elevations, and using several strains of both varieties, showed all the strains of both well adapted to the high elevations, although the Won bok strains made smaller heads than the Chiefoo strains. At the lower elevations, the Chiefoo strains produced large, loose heads, while the Won bok strains produced smaller, solid heads.

The Nozaki tetraploid, a Won bok variety, showed the best promise for lower elevation plantings, with small, solid heads and a characteristic resistance to tip burn.

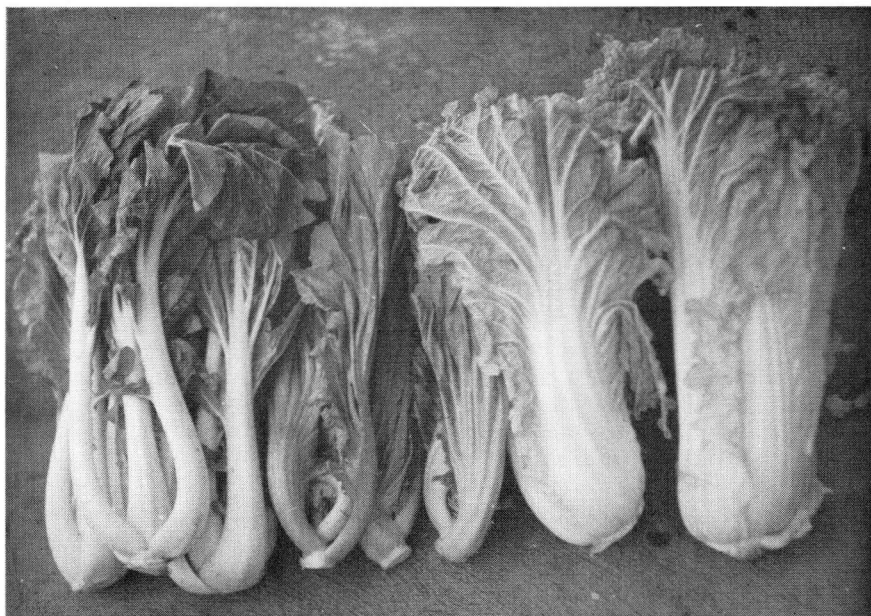
Green mustard cabbages go under the variety name of Kai choy, of which there are several strains. The most popular is the one with a wide and flat, white leaf petiole that matures with an overlapping of the inner leaves. Other strains have green leaf petioles of varying width.

The white mustard cabbage goes under the varietal name of Pak choy. The major difference between the Pak choy and the Spoon cabbage is in the latter's thinner and longer leaf petioles and smaller, oblong leaves. Very little of these types of cabbages are marketed because of poor market demand.

The Mizuna or Potherb mustard cabbage has deeply-cut leaves and long, slender petioles. It is grown and marketed mostly during the New Year season. The crop is harvested and marketed in the seedling stage for the New Year's food preparation among people who continue to prepare special oriental dishes.

Climatic Requirements

The Chiefoo prefers cool growing conditions with an average temperature of 55°-70°F. If grown under warm conditions (above 75°F.) tip burn may affect the crop, and it may not produce satisfactory heads. Prolonged average temperatures below 55°F. may cause premature bolting of the crop.



Left to right: Pak Choy, Kai Choi, and Won Bok.

The Won bok, Kai choy, Pak choy, and Mizuna will grow under warm to cool temperature conditions averaging 60°–80°F. Prolonged temperatures above 80°F. may induce tip burn.

The Kai choy and Pak choy varieties will show a tendency of premature bolting when grown under conditions of increasing day length and temperature conditions during the spring months.

Moisture Requirements

The Chinese head cabbages require a fairly abundant and constant soil moisture supply to make fast and tender growth. Any unfavorable soil moisture conditions, however, may cause tip burn and poor head formation.

Mustard cabbages and Mizuna also do best under these same soil moisture conditions.

Soil Requirements

The oriental cabbages will do best in fairly fertile soils that are well-drained, but which have a good water-holding capacity. The soil should have a pH of 5.5–7.0 and be free from nematodes. Soils with a pH below 5.5 should be limed to raise the pH above 5.5 and also to supply the calcium which is usually deficient in highly acid soils.

Soil Preparation

The soil should be plowed fairly deep and manure or other organic matter should be plowed in if available. Disking or harrowing is usually necessary after plowing to leave the soil in a fine texture.

The crop is usually planted on 2–4-foot wide beds raised to a height of about 6–8 inches, on soils that are heavy and slow in draining off. On well-drained, light soils, flat culture or sunken bed culture is used to insure the crop of a good moisture supply.

If the soil must be fumigated for nematode control with DD or EDB, it should be done after the soil is prepared. An interval of 2-3 weeks should be allowed between treatment and planting.

Planting And Thinning

Chinese head cabbages are seeded directly in the fields, with several seeds planted $\frac{1}{2}$ -inch deep, spaced 12-15 inches apart in the rows, and with rows spaced 12-18 inches apart, depending upon the size of the variety planted.

The crop is usually thinned out 2-3 weeks after planting, leaving one plant in place. The thinnings are sometimes used for transplanting into the blank spaces in the rows.

Mustard cabbages are either directly seeded in the fields by the broadcast method, or planted in rows spaced 12-15 inches apart. The seeds should be planted $\frac{1}{4}$ - $\frac{1}{2}$ inch deep. In the broadcast method, the crop is thinned out 3-4 weeks after planting. Some of the thinnings are transplanted, while others are either marketed in bunches or discarded. The crop should be thinned out to at least 8-12 inches between plants for the Pak choy and 12-15 inches for the larger growing Kai choy. If the crop is left unthinned too long, leggy and spindly plants that tend to bolt prematurely will be produced.

The seeds of the oriental cabbages should be treated with a seed disinfectant such as Arasan or Captan before planting to protect them from the damping-off diseases.

Fertilizer Applications

The oriental cabbage should be given a complete fertilizer at the rate of 750-1,000 pounds per acre for the mustards and 1,000-1,500 pounds per acre for the Chinese head cabbages.

Under very warm and sunny growing conditions, 4-12-8 or 5-10-10 fertilizer should be applied. During cool or cloudy growing periods, 8-12-5-6, 8-12-14, 10-10-5, or 8-16-8 fertilizers may be used to advantage. Excessive application of nitrogen under very warm conditions will often lead to excessively succulent growth and tip burning of the crop.

The initial application of fertilizer is made at seeding time, when one-half of the fertilizer is applied. The fertilizer should be placed in two 3-inch bands, 2 inches deep, one on each side of the seed rows for the Chinese head cabbage, and in a continuous band for the mustard cabbages, which are planted in continuous rows.

The second application of fertilizer is made right after thinning and about three weeks after planting, with the other half of the total fertilizer required. The fertilizer is top dressed in two, 2-inch bands, three to four inches away from the base and on both sides of the plants.

In some soils the deficiency of the trace element (boron) may cause unsatisfactory crop yields. In such cases the deficient element must be supplied to the plants. It may be either mixed in the fertilizers or given as a foliar spray.

Insect Control

The most common insect pests attacking oriental cabbages are the cutworms, aphids, thrips, red spider mites, cabbage webworm, and corn earworm.

Cutworms attack the young seedlings. Their presence can be detected by the appearance of damaged seedlings, which look like they were cut off at the ground. The worms themselves are seldom seen, however, because they feed at night and hide in the soil during the day. They may be controlled by spraying or dusting with DDT, or Malathion. Baits are sometimes used but are not as reliable as sprays and dusts.

Cabbage webworms are tiny caterpillars which are found feeding on and in the tissues of the growing points of young plants. They are protected by a silky web. Plants that are attacked will develop side shoot growth, thereby making the crop undesirable. A DDT spray or dust, directed into the growing points of the young plants, will control the insect.

The aphids, thrips, and red spider mites are tiny sucking pests. They feed on the foliage of the plants, usually on the lower surface of the leaves. They may be controlled by spraying or dusting with Malathion for aphids, DDT for thrips, and sulfur for red spider mites.

The corn earworm will at times bore into the maturing heads of the Chinese head cabbage to feed on the interior. Control of this insect, once it bores into the head, is almost impossible. To reduce the damage from the corn earworm, Chinese head cabbage should not be planted near corn and tomatoes and the maturing plants should be dusted or sprayed with Rotenone compounds.

Disease Control

The most common diseases of the oriental cabbage are *Downy mildew*, *Anthrachnose*, *Cercospora*, *Alternaria* leaf spots, *watery and bacterial soft rot* on the Chinese head cabbages, and *mosaic* and *white rust* on the mustard cabbages.

Downy mildew infection appears as yellowish spots on the upper leaf surfaces, with white cotton-like growth on the lower surfaces. This disease becomes serious during wet weather or under sprinkler irrigation. Spraying or dusting with Zineb or Captan will control the disease.

Anthrachnose appears as small elliptical (eye-shaped) dark brown spots on the leaf petioles and becomes serious under humid conditions. Spraying or dusting with Zineb or Captan will control the disease.

The *Alternaria* (dark brown circular spots with concentric rings) and *Cercospora* (tan-colored circular spots) leaf spots may become serious in warm, humid weather. The control is the same as for Anthracnose.

The watery soft rot (*Sclerotinia*) disease causes a watery rot with white cotton-like growth on the infected parts. Infected plants wilt and soon topple over or decay into slimy mass. This disease is usually found under cool, humid conditions. There are no effective methods of controlling it with foliar fungicidal sprays or dusts. Preplanting soil treatment with calcium cyanamide at the rate of 800–1,000 pounds per acre will give satisfactory control of this disease. A new chemical named Pentachloronitrobenzene (Terraclor 75 W) has been proved effective in the control of this disease on lettuce at 10–20 pounds per acre.

The *clubroot* disease is prevalent in the Glenwood and Volcano areas of Hawaii. This disease is caused by a fungus which invades the roots and causes abnormal swelling of roots of all crucifers. The swellings appear club-shaped and smooth, and not as irregular galls as in the case of rootknot nematode injury. Clubroot can be controlled by raising the pH of the soil to 7.0 or above by liming. On soils with a high buffering capacity where it is impractical to raise the pH by liming, the disease may be checked by drenching the seedlings in the field with a 1:1000 solution of bichloride of mercury. Pentachloronitrobenzene is effective in the control of this disease at 10–20 pounds per acre as a seedling drench.

The *white rust* disease appears as white pustules on the lower leaf surfaces of mustard cabbages. The upper leaf surfaces show yellowish discoloration over the rust spots. White rust becomes serious during warm and humid weather. Spraying or dusting the crop from the seedling stages with Zineb fungicide will give

a fair degree of control. The use of overhead sprinkling should be avoided in areas where this disease is prevalent.

Mosaic disease on mustard cabbages results in green and yellow mottled and distorted leaves, and stunted plants. Since mosaic is transmitted by the aphids, the best means of control is through control of the aphids, and the eradication of infected plants.

A virus necrotic ring spot occasionally appears on the leaf petioles of the Chinese head cabbages. Their control is similar to control measures used on the mosaic which affects the mustards.

When applying chemicals read the label carefully and follow directions accurately. Since Chinese head cabbage and white mustard cabbage are not listed in the Food and Drug Act pesticide tolerance limit regulations, use only those chemicals which are classified as non poisonous.

Apply the chemicals only in the amounts specified and at the times specified. If the instructions specify two pounds in 100 gallons of water per acre, for instance, use this amount only and no more. If a period of 14 days between last spray and harvest is called for, do not harvest in a lesser number of days. This will enable you to stay within the residue tolerance limit established under the Pure Food and Drug Act.

Harvesting

The Chinese head cabbages are harvested when the heads form a solid, compact mass. In the Won bok variety, maturity is reached in 60-80 days, while in the Chiefoo variety, maturity is attained in 80-100 days. The plants are cut at the base of the heads and the outer leaves trimmed, leaving only the head. The heads are graded and packed in crates for the market.

Mustard cabbages are ready for harvest in 40-50 days. The plants are cut at the base, and any outer leaves stained by soil or injured by insects or disease are removed. The crop is washed and tied into bunches weighing from 1-5 pounds and packed in crates for marketing.



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